National Aeronautics and Space Administration

technology opportunity

Solid and Liquid Waste Drying Bag

An Invention that can be used as a portable toilet, for medical waste, hazardous waste, or sludge from water treatment operations.

A fluid-impermeable bag, lined with a liquid-impermeable but vapor-permeable membrane for processing waste from human activities, including solids, liquids and vapors.

This invention addresses the problem of human solid waste disposal in microgravity, and consists of a soft-sided container or bag that (1) collects wet material using airflow, (2) compacts material under vacuum, and (3) dries material under applied vacuum. End products are clean water and dried, compacted, and bagged material.

The membrane-lined bag has two or more sealed edges, and an unsealed edge, with at least one sealed edge having a vacuum source connected to a port by a connection. The first end of the port includes a spacer mechanism that holds the port first-end-away from adjacent portions of the inner layer so that the vacuum force created at the first end of the port reaches most or all of the inner layer. The spacer mechanism may be a plug (e.g., a cylinder) of highly porous material, or may be two or more rod-like extensions that extend from the port first end to an adjacent portion of the inner layer.

Technology in Detail

The bag includes a liquid-impermeable and vapor-impermeable outer layer and a liquid-impermeable but vapor-permeable inner layer membrane, defining an inner bag, through which some vapor can pass. The port is located in the outer layer, and activation of the vacuum source causes some of the original vapors and vaporized liquids to pass through the membrane liner. Liquid components of the moist waste solids within the bag may also be vaporized and transported across the membrane. Waste solids, such as excrement, remain in an inner layer defined by the membrane, and are partly dried by withdrawal of vaporized liquid and vaporized liquid components in the moist solids. These waste solids are thereby trapped and sealable in the bag, while the original vapors and the vaporized portion of the liquids pass through the membrane and are received by an outer bag defined by the membrane and the outer layer of the bag. After use, the bag is sealed and stored for ultimate disposal.

Products of the system are clean, but not potable, water and dried, compacted, bagged material that may be human waste or may have other sources. The invention simplifies collection and reduces disposal cost, and is suitable for toilet waste and other liquid- or water-bearing hazardous or medical waste.

Vacuum venting of vapor through the membrane has several advantages. First, the vacuum force tends to move any waste introduced into the inner bag toward a selected region adjacent to the port in the outer layer, thereby compensating for possible absence of a gravitational force that would otherwise move human waste toward a designated "bottom" of the bag. Second, removal of the vaporized liquids and original vapors from the waste material that is originally in the inner bag reduces the storage volume and mass and temperature of the vacuum dried solid material that remains. Third, the strongest odor-producing portion of the waste is isolated from the remainder after processing and can be stored or disposed of separately from the remainder. Fourth, vacuum-dried waste is more stable than non-dried waste. Fifth, venting of the vapor removes heat from water.

Patents

This technology has been patented (U.S. Patent 7,490,367).

Licensing and Partnering Opportunities

This technology is part of NASA's Innovative Partnerships Program, which seeks to transfer technology into and out of NASA to benefit the space program and U.S. industry. NASA invites companies to inquire about licensing possibilities for this technology for commercial applications.

For More Information

If you would like more information about this technology, please contact:

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